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(71) Applicant
The Furukawa Electric Co Ltd (Japan),
No 6-1 Marunouchi 2-chome, Chiyoda-ku, Tokyo 100,
Japan

(72) Inventors
Yasuro Furui,
Kunihiro Matsubara,
Akira Iino,
Mikio Ogai

(74) Agent and/or Address for Service
Urquhart-Dykes & Lord, 419B Midsummer House,
Midsummer Boulevard, Central Milton Keynes MK9 3BN

# (54) Method of treating preform for optical fiber

(57) A method in which a silica-rich porous soot preform is dehydrated and vitrified to from a base material for an optical fiber having a transmitting characteristic at 1.2 to 1.6 micron wavelength 5 dB/km or less. The preform is dehydrated, thereafter transparently vitrified separately from the dehydrating step. The dehydrating step includes forming a dehydrating atmosphere of He, $O_2$ and a dehydrating gas, setting the treating temperature to substantially a dehydration-starting temperature or higher but less than a close-pore forming temperature, and passing the porous soot preform through the treating temperature range of such dehydrating atmosphere. The vitrifying step includes forming an atmosphere of He and $O_2$ or only He, setting the treating temperature to the lowest vitrifying temperature or higher, and passing the preform after the dehydrating step through the treating temperature in the vitrifying atmosphere. This method can produce an optical fiber material that does not exhibit a peak of increased loss due to the discovery in 1.52 micron of wavelength.

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The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

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FIG. 1

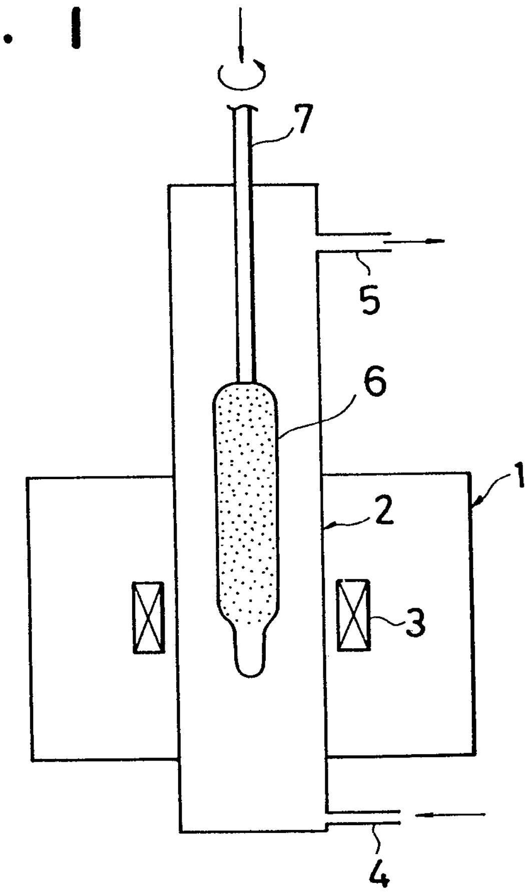



FIG. 2

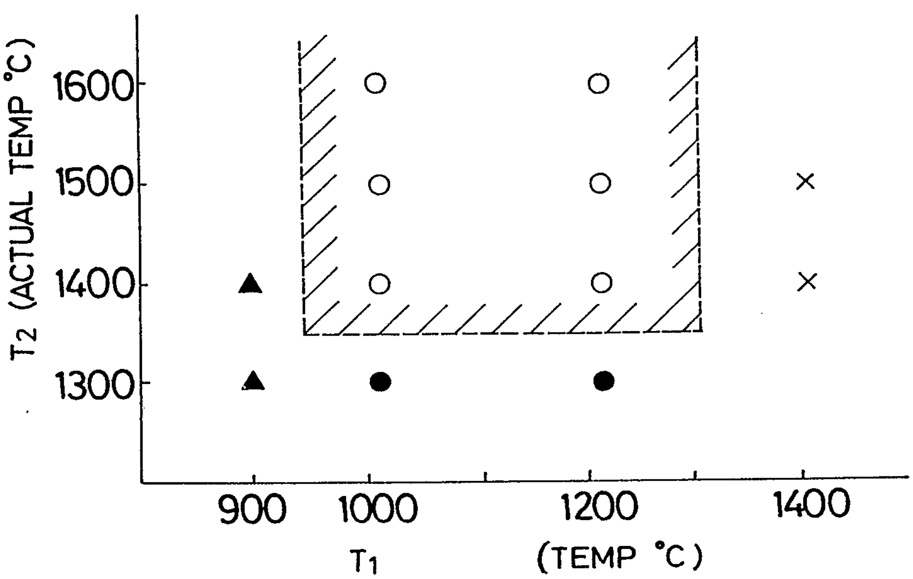


FIG. 3

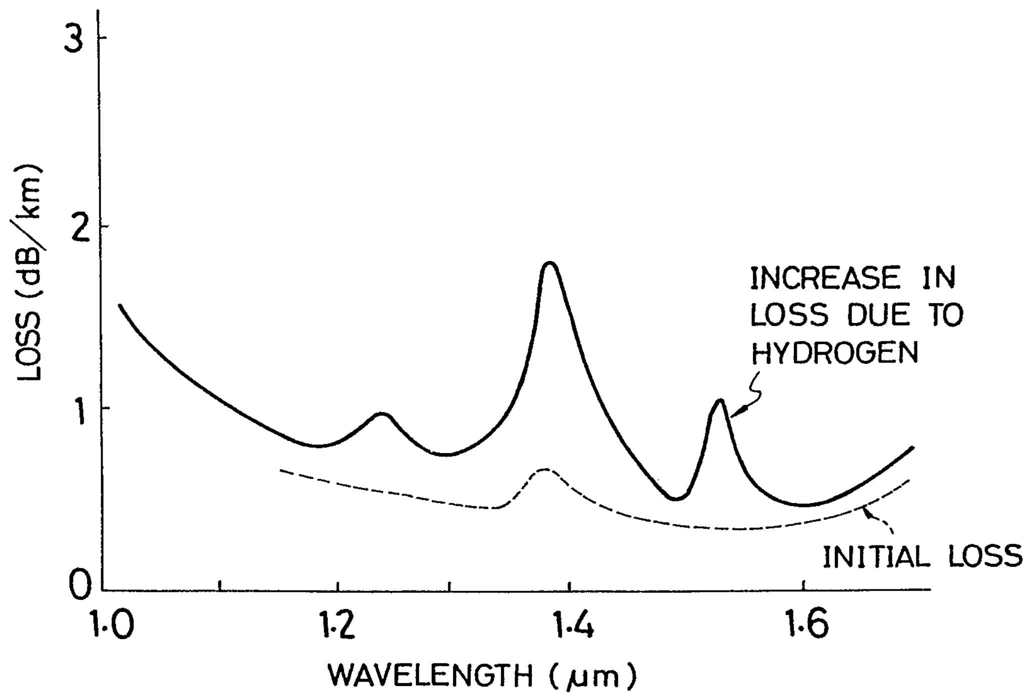
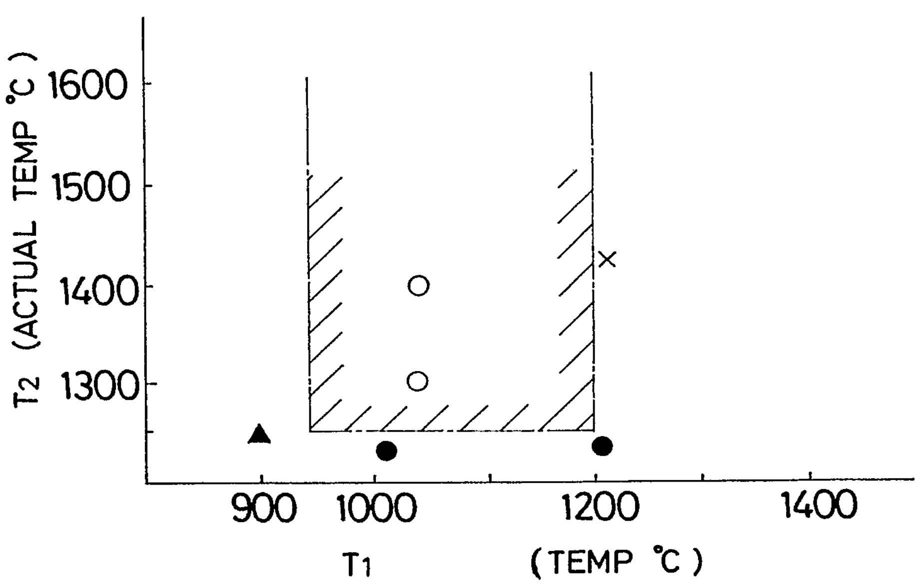

3
2
1
0
LOSS (dB/km)
INCREASE IN LOSS DUE TO HYDROGEN
INITIAL LOSS
1·0
1·2
1·4
1·6
WAVELENGTH (μm)

FIG. 4


T2 (ACTUAL TEMP °C)
1600
1500
1400
1300
900
1000
1200
1400
T1
(TEMP °C)

SPECIFICATION

**Method of treating preform for optical fiber**

This invention relates to a method of treating a preform for an optical fiber to dehydrate the porous preform and to transparently vitrify the preform and, more particularly, to a method of treating the preform to obtain the optical fiber without increasing its loss due to hydrogen.

A porous soot preform for an optical fiber made of a quartz is generally formed by a VAD method (Vapour Phase Axial Deposition Method) or an OVPO method (Outer Vapor Phase Oxidation Method), the preform is then hydrated, and transparently vitrified to become a transparent preform for the optical fiber.

Means for dehydrating and transparently vitrifying a porours soot preform is disclosed in U.S. patent No. 3,933,454 (hereinafter referred to as "a second prior art"), and means which had been invented before the above Patent is disclosed in U.S. Patent No. 3,459,522 (hereinafter referred to as "a first prior art").

A porous soot preform to be treated in the second prior art is formed by accumulating glass soot produced through a flame hydrolytic reaction, and such a porous soot preform is simultaneously dehydrated and transparently vitrified in atmosphere containing chlorine gas.

In the case of the optical fiber obtained from a preform treated in the second prior art, the transmitting characteristic in 650 to 1,100 nm band of wavelength is approx. 10 dB/km, but exhibits an absorption peak in 950 nm of wavelength.

On the other hand, in the first prior art, a porous soot preform is produced by means except the flame hydrolytic reaction, the porous soot preform is dehydrated in atmosphere containing chlorine, and the dehydrated preform is transparently vitrified in atmosphere containing nonchlorine, as so-called "two step treaments" as its feature.

In the first prior art, one reason of preforming the two steps of dehydrating and transparently vitrifying the preform is based on an economic concept, and the other reason is based on a possibility of causing a crack in the glass due to staying a large quantity of chlorine in the preform when the preform is exposed in the atmosphere containing chlorine for a long period.

However, the glass treated in the first prior art has worse transmitting characteristic than that of the second prior art.

Further, the second prior art described with respect to the first prior art that the porous soot preform obtained by the flame hydrolytic reaction was not appropriate for the dehydration.

In other words, a large quantity or chlorine in the atmosphere containing the chlorine used in the first prior art produces voids in the next treatment of the porous soot preform and contaminants contained in the chlorine source of the purity sold in the market exceeds the allowable limit and are possibly introduced into the glass.

In addition, in the first prior art, after the porous soot preform is dehydrated in a chlorinating chamber, when the hydrated preform is moved from the chlorinating into a solidifying room for transparently vitrifying, moisture is again possibly introduced into the dehydrated preform.

Moreover, the steps of simultaneously dehydrating and transparently vitrifying the preform can enhance the economic effect as compared with the two steps in the first prior art.

This background is motive to simultaneously perform the steps of dehydrating and transparently vitrifying in the second prior art.

If hydrogen ($H_2$) is diffused and trapped in the optical fiber, its transmitting characteristic is deteriorated in an ageing manner known per se, but the technical process relative to the remedy has been disclosed in detail in "Nikkei Electronics" (issued on December 3rd, 1984 in Japan) entitled "Loss Increasing Problems of Optical Fiber", and the absorption peak of SiOH and GeOH in 1.39 micron and 1.41 micron of wavelength, the absorption peak of hydrogen molecule in 1.24 micron of wavelength have been heretofore noted as the peak of increased loss due to hydrogen, but important study and report relative to the peak of increased loss due to the hydrogen except this has not yet been observed.

However, in the study of the inventors of this invention relative to the transmitting characteristic of the optical fiber, an important peak of increased loss which has not yet been disclosed, i.e. an absorption peak of 1.52 micron of wavelength has been discovered as the peak of increased loss except the above.

This absorption peak of 1.52 micron is considered to be caused by the Si-H vibration absorption.

The features of the behaviour of the absorption peak according to the inventors of this invention are discovered in that when the optical fiber in the step of producing the optical fiber cable is experienced at the high temperature of 80 to 100°C, the peak tends to be feasibly occur and the peak once exhibited has a tendency of gradually decreasing thereafter.

Figure 3 shows the loss spectrum of the optical fiber in which the absorption loss is actually increased in 1.52 micron of wavelength.

As apparent from Figure 3, the feature that this absorption peak is exhibited is that the absorption peak is presented in 1.55 micron band and the losses in 1.39 and 1.24 micron bands also increases simultaneously, and it is accordingly understood that the deterioration in the transmitting characteristic of 1.2 to 1.6 micron takes place.

Since such absorption peaks are in problems of recognizing in the optical fiber when the transmitting characteristic in 1.2 to 1.6 micron of wavelenth become 5 dB/km or less, they are not discovered in the

wavelength range and the transmitting characteristic of the second prior art, and cannot be entirely predicted in the first prior art in which the transmitting characteristic is worse than the second prior art.

Accordingly, an object of this invention is to provide a method of treating a preform for an optical fiber which is made to consider the above-described drawbacks and problems and which can obtain the optical fiber that does not cause the peak of increased loss due to the discovery in 1.52 micron of wavelength.

According to this invention, there is provided a method of treating a preform for an optical fiber for dehydrating and transparently vitrifying a silica-rich porous soot preform to obtain a preform for an optical fiber having transmitting characteristic in 1.2 to 1.6 micron of wavelength 5 dB/km or less, previously dehydrating the preform, thereafter transparently vitrifying the preform separately from the dehydrating step, said dehydrating step including forming dehydrating atmosphere with He, $O_2$ and dehydrating gas, setting the lowest treating temperature to substantially dehydration starting temperature or higher of the porous soot preform less than independently closed pore forming temeprature, passing the porous soot preform through the treating temperature range of such dehydrating atmosphere, said vitrifying step including forming transparently vitrifying atmosphere with He and $O_2$ or only He, setting the treating temperature to the lowest vitrifying temperature or higher, and passing the preform after the dehydrating step through the treating temperature in the vitrifying atmosphere.

In the method of this invention, since separately performing the dehydrating and transparently vitrifying steps when the porous soot preform produced by a VAD method or an OVPO method is dehydrated and transparently vitrified in the predetermined atmospheres, respectively, the remaining chlorine amount of the preform after vitrifying becomes very slight, and the optical fiber having preferable transmitting characteristic can be obtained from the preform.

More particularly, in case of the method of executing the steps of dehydrating and transparently vitrifying the porous soot preform in the same step, the preform is tansparently vitrified in the atmosphere containing chlorine. Thus, the remaining chlorine in the tansparently vitrified preform increases to cause defect in the structure in the glass, and to cause an increase in the loss due to the hydrogen by the mechanism of securing the hydrogen. However, both steps are separately executed in this invention, thisproblem can be eliminated.

In the dehydrating step of this invention, the atmosphere is formed of He and $0_2$, and dehydrating gas (chlorine gas, chlorinated thionyl, fluorosilane, etc.), and the treating temperature is set substantially to the dehydrating reaction starting temperature or higher and less than independently closed pore forming temperature.

The reason why the dehydrating temperature is set substantially to the dehydrating reaction starting temperature or higher to less than the independently closed pore forming temperature is set is because:

The reason why the lower limit of the dehydrating temperature is set substantially to the dehydrating reaction starting temeprature or higher is because when the treating temperature is lower than the lower limit of the treating temperature, an obvious reason that the effective dehydration cannot be performed, while the reason why the upper limit of the dehydrating temperature is set to less than the independently closed pore forming temperature is because, when it is higher than this temperature, the porous soot preform is advanced in the sintering, the independently closed pores of the preform are produced to enclose chlorine in the pores to cause the loss to increase to the hydrogen.

The step of transparently vitrifying the preform of this invention form the atmosphere with He and $0_2$ or only with He, and sets the treating temperature to the lowest transparently vitrifying temperature or higher.

Since the atmosphere does not contain the chlorine, the defect of the glass does not occur in case of transparently vitrifying the preform, and since the treating temperature is the transparently vitrifying temperature or higher, the composition of the glass is enhanced in the unformity, and the transmitting characteristic of the optical fiber is improved.

Thus, the optical fiber having preferable transmitting characteristic can be obtained from the preform treated according to the method of this invention, and since the preform treating conditions are suitable, the peak of the increased loss due to hydrogen owing to the presence of 1.52 micron of wavelength does not occur in the optical fiber as apparent from the experiments to be described in greater detail.

The above and other related objects and features of the invention will be apparent from a reading of the following description of the disclosure found in the accompanying drawings and the novelty thereof pointed out in the appended claims.

*Figure 1* is an explanatory view schematically showing a method of treating a preform for an optical fiber and an apparatus used therefor according to this invention;

*Figure 2* is an explanatory view showing the range of adequate treating temeprature in the case of using chlorine as dehydrating gas in the method of this invention;

*Figure 3* is an explanatory view showing the loss spectrum of the 1.55 micron band of wavelength; and

*Figure 4* is an explanatory view showing the range of the adequate treating temperature in case of using $SiF_4$ as dehydrating gas in the method of this invention.

Embodiments of a method of treating a preform for an optical fiber according to this invention will now be described in detail with reference to the accompanying drawings.

Figure 1 exemplifies an apparatus used for the method of this invention. In Figure 1, reference numeral 1 designates an electric furnace, numeral 2 designates a muffle tube of the furnace 1, and numeral 3 designates a carbon heater of the furnace 1.

The muffle tube 2 has a gas inlet 4 in the lower portion, and a gas outlet 5 in the upper portion.

Reference numeral 6 designates a silica-rich porous soot preform produced by a VAD method or an OVPO method, and the preform 6 is supported by a supporting rod 7 of silica.

In Figure 1, when the preform 6 is dehydrated, He, $O_2$ and/or dehydrating gas (e.g. $Cl_2$) are supplied from the inlet 4 into the muffle tube 2 to prepare a predetermined atmosphere in the tube 2, and the treating temperature (actual temperature) is set by the heater 3 to approx. 900 to 1,300°C so as to set the treating temperature in the tube 2 to substantially dehydrating reaction starting temperature or higher and less than independently closed pore forming temperature.

The preform 6 is inserted from above into the muffle tube 2, and moved down at a suitable moving speed toward the dehydrating temperature zone to sequentially dehydrate the preform 6 from its lower end.

The preform 6 becomes sintered state by this dehydration. Since the treating temperature of this case is less than the independently closed pore forming temperature as described above, the pores of the preform 6 are not closed, and the preform 6 does not enclose dehydrating gas ($Cl_2$) introduced into the pores.

The preform 6 after the dehydration is transparently vitrified by the furnace 1 in Figure 1 or a similar electric furnace 1 to that in Figure 1 prepared separately.

When the furnace 1 after dehydrating is subsequently used for transparently vitrifying the preform, purging gas is flowed in advance into the muffle tube 2 to completely exclude the dehydrating atmospheric gas from the interior of the furnace, and to once raise the dehydrated preform upward from the tube 2.

When another electric furnace for transparency vitrifying the preform is used, the electric furnaces for dehydrating and for transparently vitrifying the preform are disposed in advance in a casing held in the cleanness higher than a predetermined value, the dehydrated preform in the furnace for dehydrating is moved to the furnace for vitrifying the preform, and the dehydrated preform is disposed in the upper portion of the muffle tube of the furnace for vitrifying the preform.

Then, He and $O_2$ or only He is supplied from the inlet 4 into the tube 2 to maintain a predetermined atmosphere in the tube 2, the treating temperature (actual temperature) in the tube 2 is set by the heater 3 to approx. 1350 to 1650°C to set the lowest treating temperature in the tube 2 to the transparently vitrifying temperature or higher, the dehydrated preform 6 is filled in the tube 2, and moved (downward) toward the transparently vitrifying temperature zone at a suitable speed to sequentially transparently vitrify the preform 6 from the lower end.

Thus, the preform 6 is completely dehydrated and transparently vitrified.

When the dehydrated preform 6 is transparently vitrified, the preform treating speed (moving speed) in the tube 2 is preferably at a low speed to obtain preferable transmitting characteristic, and preferably, for example, at 100 mm/hr.

The treating temperature at the transparently vitrifying time is not particularly limited, but since the tube 2 is melted at approx. 1,700°C, its upper limit temperature is in fact preferably 1,650°C.

Then, experimental examples of the method of this invention will now be described.

In the experimental examples described below, a single mode optical fiber having 9 micron of core dimater, 125 micron of pure silica clad diameter and $\Delta = 0.3\%$ was produced from a preform produced by the VAD method. An example of testing method, the optical fibers were introduced into 100% hydrogen atmosphere at 100°C, maintained for 15 min., the optical fibers were then removed, the loss spectra were measured, and the loss increasing characteristics due to the hydrogen were compared with the initial loss characteristics and evaluated.

The wavelength used in this evaluation was 1.52 micron.

The experiments were executed by altering variously the dehydrating and transparently vitrifying conditions of the porous soot preform in Tables 1 and 2, and the single mode optical fibers obtained from the preform were evaluated, and the optimum, conditions of the treatments were discussed.

*Table 1*

| | Optical fiber | Porous soot preform treating conditions | | Results |
|---|---|---|---|---|
| | | Treating temp. | Atmospheric gas (l/min) | Increase in loss due to hydrogen (at: 1.52 micron) |
| Treating method I | a | 1480°C | He : 65<br>$O_2$ : 6.5<br>$Cl_2$ : 0.65 | 1.2 dB/km |
| | b | 1530°C | He : 65<br>$Cl_2$ : 0.65 | 1.8 dB/km |
| | c | 1580°C | He : 65<br>$O_2$ : 6.5<br>$Cl_2$ : 0.65 | 1.4 dB/km |

*Table 2*

| | Optical fiber | Porous soot preform treating conditions | | | Results |
|---|---|---|---|---|---|
| | | Treating temp. | | Atmospheric gas (l/min) | Increase in loss due to hydrogen (at: 1.52 micron) |
| | | T1 | T2 | | |
| Treating method II | a | 1100 °C | 1530 °C | He : 65<br>$O_2$ : 6.55<br>$Cl_2$ : 0.65 | 0.05 dB/km |
| | b | 1200 °C | 1580 °C | He : 65<br>$O_2$ : 6.5<br>$Cl_2$ : 0.65 | 0.08 dB/km |

The treating method I in Table 1 achieved the simultaneously dehydrating and transparently vitrifying steps, and the treating method II in Table 2 performed separately dehydrating and transparently vitrifying steps.

The treatments were executed by the electric furnace in Figure 1.

In Table 2, T1 designates the treating temperature at the dehydrating time, and T2 designates the treating temperature at the transparently vitrifying time.

As apparent from the results in Tables 1 and 2, in case of the treating method I resulted an increase in the loss due to the hydrogen as compared with that of the treating method II.

The reason why the loss in the treating method I increase is because the porous soot preform is transparently vitrified in the atmosphere containing chlorine, and the remaining chlorine in the glass, the formation of the defect in the glass structure due to the remaining chlorine, and the adherence of the hydrogen to the defect in the glass structure are considered. The reason why the loss in the treating method II does not increase is because the dehydrating and transparently vitrifying steps are separately performed, and it is assumed that problems arised in the method I did not take place.

On the other hand, even in the method II, the difference in the characteristics between the optical fibers a and b of the samples of this case was observed.

This suggests the presence of more suitable treating conditions if the treating temperature (which also contributes to the treating time) in the treating method II is further studied.

From this point of view, the following experiments were conducted to optimize in the treating method II.

The ranges of parameters in the experiments are as in Table 3. In the experiments, the parameters were numerically variously combined, the porous soot preform was dehydrated and transparently vitrified, the treated preform was drawn to obtain the optical fibers, and tests for the increase in the loss due to the addition of hydrogen were conducted.

*Table 3*

| Parameter | Experimented Range |
|---|---|
| Dehydrating temperature (°C) | 900 ~ 1300 |
| Atmospheric gas at dehydrating time | Combination of He, $Cl_2$, $O_2$ |
| Transparently vitrifying Temperature (°C) | 1350 ~ 1650 |

The temperatures in Table 3 are maximum temperatures in the muffle tube, and the supplying amounts of gases are He = 65 liters/min., $O_2$ = 6.5 liters/min, and $Cl_2$ = 0.65 liter/min.

In comparison of atmospheric gases of the combination of He and $Cl_2$ with that of He, $Cl_2$ and $O_2$, all of the optical fibers obtained from the preform treated in the former atmosphere increased in the loss due to the hydrogen, while the optical fibers obtained from the preform treated in the latter atmosphere slightly increased in the loss due to he hydrogen.

Then, when the same dehydrating atmosphere as that in the latter and the same transparently vitrifying atmosphere as that described above were employed (He and $O_2$ or only He) and the treating temperature T1 at the dehydrating time and the transparently vitrifying temperature T2 were altered produce a predetermined preform, and the preform was then drawn to produce optical fibers for various samples.

These optical fibers were conducted for the loss increase test due to the hydrogen, and the results were shown in Figure 2.

In Figure 2, the mark "X" designates the increase in the loss due to the hydrogen, the mark "O" designates no increase in the loss due to the hydrogen, the solid mark "●" designates that no increase in the loss due to the hydrogen but its initial loss is large, and the mark "▲" designates that the 0H absorption loss is large.

In Figure 2, in case of T1 = 900°C, chemical dehydration due to the decrease in the temperature and hence the dehydration of the base material for the optical fiber becomes insufficient, and the initial 0H absorption loss is considered due to the reason to be large, and that marked with solid "O" is considered that the glass vitrifying temperature is excessively low and the irregular glass composition occurs.

On the other hand, the range marked with "X" is considered that the dehydrating temperature is excessively high, and the independently closed pores (due to the introduction of chlorine) occurred.

On the other hand, the range that the marks "O" are presented in a scattered state did not arise the abovementioned various problems such as insufficient dehydration, irregular glass composition, formation of independently closed pores, and preferable results are exhibited in the initial loss and the increase in the loss due to the hydrogen.

From these results, the temperatures T1 and T2 of the case that the $Cl_2$ were used as the dehydrating gas are considered to be set within the range surrounded by the broken line in Figure 2.

Then, the experimental example using $SOCl_2$ instead of $Cl_2$ as the dehydrating gas in this invention will be described.

When the same experiments as those in Tables 1 and 2 were conducted, $SOCl_2$ was used instead of $Cl_2$ as the dehydrating gas, and the dehydrating and transparently vitrifying steps were conducted under the conditions shown in Tables 4 and 5.

*Table 4*

| | Optical fiber | Porous soot preform treating conditions | | Results |
|---|---|---|---|---|
| | | Treating temp. | Atmospheric gas (l/min) | Increase in loss due to hydrogen (at: 1.52 micron) |
| Treating method III | a | 1480°C | He : 65<br>$O_2$ : 6.5<br>$SOCl_2$ : 0.65 | 1.4 dB/km |

*Table 5*

| | Optical fiber | Porous soot preform treating conditions | | | Results |
|---|---|---|---|---|---|
| | | Treating temp. | | Atmospheric gas (l/min) | Increase in loss due to hydrogen (at: 1.52 micron) |
| | | T1 | T2 | | |
| Treating method IV | a | 1150 °C | 1550 °C | He : 65<br>$O_2$ : 6.5<br>$SOCl_2$ : 0.65 | 0.05 dB/km |
| | b | 1350 °C | 1600 °C | He : 65<br>$O_2$ : 6.5<br>$SOCl_2$ : 0.65 | 0.09 dB/km |

The treating method III in Table 4 achieved the simultaneously dehydrating and transparently vitrifying steps, the treating method IV in Table 5 performed separately dehydrating and transparently vitrifying steps, and the electric furnace in Figure 1 was used in both the treatments.

In Table 5, T1 designates the treating temperature at the dehydrating time, and T2 designated the treating temperature at the transparently vitrifying time.

As apparent from the results in Tables 4 and 5, in case of the treating method III resulted an increase in the loss due to the hydrogen as compared with that of the treating method IV, and the similar trend to the previous result described above is exhibited.

This exhibited in this invention that, even if $SOCl_2$ is used as the dehydrating gas, the same advantages as those of the $Cl_2$ can be expected.

Then, the experiments of the case that fluorosilane was used as the dehydrating gas will be described.

When the same experiments described with reference to Tables 1 and 2 awere conducted, $SiF_4$ was used instead of $Cl_2$ as the dehydrating gas, and the dehydrating and transparently vitrifying steps were executed under the conditions shown in Tables 6 and 7.

*Table 6*

| | Optical fiber | Porous soot preform treating conditions | | Results |
|---|---|---|---|---|
| | | Treating temp. | Atmospheric gas (l/min) | Increase in loss due to hydrogen (at: 1.52 micron) |
| Treating method V | a | 1420°C | He : 65<br>$O_2$ : 6.5<br>$SiF_4$ : 0.35 | 1.1 dB/km |
| | b | 1500°C | He : 65<br>$O_2$ : 6.5<br>$SiF_4$ : 0.35 | 1.3 dB/km |

*Table 7*

| | Optical fiber | Porous soot preform treating conditions | | | Results |
|---|---|---|---|---|---|
| | | Treating temp. | | Atmospheric gas (l/min) | Increase in loss due to hydrogen (at: 1.52 micron) |
| | | T1 | T2 | | |
| Treat-ing method VI | a | 1200 °C | 1420 °C | He : 65<br>$O_2$ : 6.5<br>$Cl_2$ : 0.35 | 0.8 dB/km |
| | b | 1050 °C | 1400 °C | He : 65<br>$O_2$ : 6.5<br>$SiF_4$ : 0.35 | 0.05 dB/km |

The treating method V in Table 6 achieved the simultaneously dehydrating and transparently vitrifying steps similarly to the above, and the treating method VI in Table 7 performed separately dehydrating and transparently vitrifying steps, and the treatments were executed by the electric furnace in Figure 1.

In Table 7, T1 designates the treating temperature at the dehydrating time, and T2 designates the treating temperature at the transparently vitrifying time.

Even in the results in Tables 6 and 7, in case of the treating method VI resulted an increase in the loss due to the hydrogen as compared with that of the treating method Vi, and the similar trend to the previous result described above is exhibited.

Therefore, it can be understood that $SiF_4$ is also effective as the dehydrating gas in this invention, but when such $SiF_4$ is used as the dehydrating gas, fluorine is doped in the treating glass. Thus, a trend that the dehydrating temperature T1 and the transparently vitrifying temperature T2 were lower by approx. 100°C as compared with the previous examples was observed.

From the results of the experiments, in case that $SiF_4$ is used as the dehydrating gas, it can be said that the temperatures T1 and T2 may be set to the range surrounded by a dotted broken line of Figure 4.

The marks "X", "O", "●" in solid state, and "▲" in Figure 4 designate the same as those in Figure 2.

In the examples of the above experiments, $SiF_4$ was listed as the dehydrating gas which represents as fluorosilane, and $SF_6$, $SiHF_3$, $SiH_2F_2$, and $SiH_3F$ are also effective, and $CF_6$ is also effective.

However, in case that the dehydrating gas which etches the silica muffle tube is used, it is necessary to treat the tube with corrosion resistance.

According to the method of this invention as described above, the preform for the optical fiber which provides small initial loss and does not cause an increase in the peak of the loss due to the hydrogen presented in 1.52 micron of wavelength can be provided.

CLAIMS

1. A method of treating a preform for an optical fiber for dehydrating and transparently vitrifying a porous soot preform of quartz to obtain a preform for an optical fiber having transmitting characteristic in 1.2 to 1.6 micron of wavelength 5 dB/km or less, comprising:- previously dehydrating the perform, thereafter transparently vitrifying the preform separately from the dehydrating step, said dehydrating step including froming dehydrating atmosphere with He, $O_2$ and dehydrating gas, setting the treating temperature to substantially dehydration starting temperature or higher of the porous soot preform less than the independently closed pore forming temperature, passing the porous soot preform through the treating temperature range of such dehydrating atmosphere, said vitrifying step including forming transparently vitrifying atmosphere with He and $O_2$ or only He, setting the treating temperature to the lowest vitrifying temperature or higher, and passing the preform after the dehydrating step through the treating temperature in the vitrifying atmosphere.

2. The method according to Claim 1, wherein the porous soot preform produced by a VAD method is dehydrated and transparently vitrified.

3. The method accirding to Claim 1, wherein the porous soot preform produced by an OVPO method is dehydrated and transparently vitrified.

4. The method according to any of Claims 1 to 3, wherein the treating temperature in the dehydrating step is set to 900 to 1,300°C.

5. The method according to any of claims 1 to 3, wherein the treating temperature in the transparently vitrifying step is set to 1,350 to 1,650°C.

6. The method according to any of claims 1 to 4, wherein the dehydrating gas is chlorine gas.

7. The method according to any of claims 1 to 4, wherein the dehydrating gas is chlorinated thionyl.

8. The method according to any of claims 1 to 4, wherein the dehydrating gas is fluorosilane.

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**TITLE:** Treating an optical fibre preform by dehydrating and transparently vitrifying in separate steps

**INVENTOR:** FURUI Y; IINO A ; KOKAYU M ; LINO A ; MATSUBARA K ; OGAI M

**PATENT-ASSIGNEE:** FURUKAWA ELECTRIC CO LTD[FURU] , KOGA ELEC IND CO LT[KOGAN]

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|---|---|---|
| GB 2171691 A | September 3, 1986 | EN |
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|---|---|---|---|
| GB 2171691A | N/A | 1986GB-000792 | January 14, 1986 |
| JP 61270232A | N/A | 1986JP-003895 | January 11, 1986 |
| JP 92042340B | Based on | 1986JP-003895 | January 11, 1986 |

**INT-CL-CURRENT:**

| TYPE | IPC DATE |
|---|---|
| CIPP | G02B6/00 20060101 |
| CIPS | C03B20/00 20060101 |
| CIPS | C03B37/014 20060101 |
| CIPS | C03B37/018 20060101 |
| CIPS | C03B8/04 20060101 |

**ABSTRACTED-PUB-NO:** GB 2171691 A

**BASIC-ABSTRACT:**

Optical fibre quartz soot preform is treated by: dehydrating at an elevated temp. below the pore closing temp. in an atmos. of He, O2 and a dehydrating gas; and separately vitrifying at elevated temp. in the He, opt. with O2. The fibre obtd. from the resulting preform has a transmitting characteristic at 1.2-1.6 micron of 5dB/km or less.

ADVANTAGE - Residual Cl2 content is very low and prod. has good transmitting characteristics.

**TITLE-TERMS:** TREAT OPTICAL FIBRE PREFORM DEHYDRATE TRANSPARENT VITREOUS SEPARATE STEP

**DERWENT-CLASS:** L01 P81 V07

**CPI-CODES:** L01-F03F2;

**EPI-CODES:** V07-F01A1;

**UNLINKED-DERWENT-REGISTRY-NUMBERS:** ; 1727U ; 1781U

**SECONDARY-ACC-NO:**

**CPI Secondary Accession Numbers:** 1986-100705

**Non-CPI Secondary Accession Numbers:** 1986-174865